

Overview

Scope AR worked with a premier technical college CNA-Q to conduct a study to analyze the effects of using augmented reality (AR) instructions versus traditional paper-based manuals in a classroom training environment. The study contained four pairs of operators with a varying degree of experience performing a maintenance procedure on a water pump. The AR instructions were delivered on an iPad that was mounted on a tripod and the results of the study were released by CNA-Q shared below.

Study Findings

Time to Completion

For the four pairs that completed the exercise, overall, there was no appreciable difference in time. All were between 42 - 47 minutes.

However, it was noted that due to the position of the tripod holding the iPad, the AR group had 'travel time' where they had to step back to look at the screen and then step forward to perform the action whereas the control group had the manual much closer and therefore little to no 'travel time' was needed.

Errors

The AR group had no noticeable errors in completing the task.

However, the control groups had four mistakes that the supervising instructors considered medium to serious in the classroom or in an industrial environment. Interestingly, the mistakes were made by the control group that had the most previous experience with maintaining water pumps in their respective companies. The mistakes noted were as follows:

1. Skipping a step and not realizing it until much later in the process.
2. Failure to complete a step correctly.
3. Unable to understand a procedure from the graphic or description.
4. Working on different part of the process without communicating with their partner.

In the classroom environment, an instructor would have probably been able to catch the errors and offer correction and assistance. However, in the event of a non-supervised environment, potential hazards to personnel and / or machines were created as well as time lost in production.

Interaction and Communication

Instructor Assistance - The control group sought assistance from the instructor noticeably more than the AR group. Questions / clarification about step details and how to complete them were the main focus. In turn, the instructors were paying a lot more attention to the control group to make sure that they were not making further errors.

Partner Communication - The AR groups communication was more about the process of the steps (Remove that bolt first and then that one). They appeared to be working together. The control groups had more discussion about how to do something (Where do I put the screwdriver to do that?) and often appeared to be working on separate components rather than working together.

Technology Use

The biggest concern from participants and instructors was that the use of a iPad on a tripod in a 'real' repair situation would not be feasible. This was obvious from the video as well. The students, who all have job experience, felt that using a tripod created its own safety issues and the time it took to move back and forth was not the best way to work. They also felt that the mess and dirt in the plant would destroy the iPad very quickly.

There were no negative comments about the software / animations. They felt that the animations were a great help and wanted more of them for their other class projects and learning.

The instructors also wanted more AR instructions for use in class. In the post interviews, both instructors were enthusiastic about getting further resources for this type of training.

Conclusions

Time to Completion

For this particular study, time to completion was not a significant factor for either group. However, the instructors and study designers believe that there could be factors that would change that in the future. Investigation into the type and placement of the hardware used are primary considerations.

Errors

The type and amount of errors for the control group vs the AR group is considerable. It was obvious that the use of AR increased safety for both the technicians and machines. The reasons for the mistakes by the control group might be hard to pin down, but for whatever reason, the use of AR appeared to remove or limit the factors that lead to mistakes. From the instructor's perspective, limiting errors is a key goal for training in a potentially dangerous environment.

AR for Educational Training

Both participants and instructional supervisors felt that AR is a needed addition to educational training. Beyond the excitement of a new technology, the fact that students did not have to rely on their language levels to complete a task was a major boost to their confidence and task engagement. Instructors also felt that the visual component was a major step forward in training methods that allowed them to focus on skill training and not language development.

Consistency of materials and teaching is a key factor for training. The use of AR allows for students to experience the same level of training.

Student Learning

The use of AR for job training creates the environment for self learning and skill building. The instructors felt that the possibilities for students to review processes on their own or with partners away from the classroom was an important tool.

For group activities, instructors felt they could use the AR instructions as pre-training before going into the lab. This would maximize the time used in the labs and allow instructors to focus on activities that would further enhance learning.

Future Considerations / Recommendations

Version Control

As with industry, education also has trouble with version control when it comes to curriculum and the growing use of Bring Your Own Technology (BYOT). Using AR instructions could assist with ensuring that all participants had current curriculum and up to date processes for their education.

AR Training for Instructors

According to industry estimates, mass adoption of AR will happen over the next two years. Any new students below the age of 18 entering their educational training over the next 4 years will be familiar with AR and expect to be trained in current and near future industry methods. With the use of AR being incorporated into personal and professional environments, it makes sense to train instructors to not only understand AR but learn how to build and use AR as part of their normal educational training.

In the case of CNA-Q, the Engineering and TPP programs are already moving towards a Competency Based Education (CBE) model. AR compliments CBE goals and methods very well and therefore should be offered as standard training for interested instructors with a view to training as many as possible over the next 2 years.